Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 October and 31 December, 2004

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March 2005
PRD Contribution: #PRD-04/05-07

Background

The U.S. Atlantic Pelagic Longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the central North Atlantic ocean. The longline fishery has a documented history of incidental takes of non-target species including billfish, marine turtles, and marine mammals. During recent years there have been elevated takes of leatherback turtles in the Gulf of Mexico (Garrison, 2003; Garrison and Richards, 2004). As a result, a Biological Opinion on the pelagic longline fishery was recently developed by NOAA Fisheries under the Endangered Species Act requiring several actions to be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the NED, with restrictions, on June 30, 2004 and similar restrictions were imposed upon the rest of the fleet effective August 5, 2004. This quarterly report includes fishing under the new regulatory regime.

The biological opinion requires quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirements and includes the observed fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from October 1, 2004 to December 31, 2004.

While it would be desirable to estimate the absolute level of takes (i.e., total number of turtles taken), this is not currently possible because the fishery effort data is reported on logbook forms by fishing captains. These data are not available until several months after the end of any given quarter. Therefore, I present the bycatch rate (i.e., catch per unit effort) based solely on observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate for each quarter and fishing area during 2004 is compared to that observed in 2003 and the average of the previous five years (1999-2003) to assess whether or not the observed rate in 2004 is unusually high or low. Bycatch rates are calculated applying the delta log-normal method using hooks as the unit of effort, and the analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of 141 longline sets (~112,000 hooks) were observed during quarter 4 of 2004 (Table 1). The Gulf of Mexico had the highest number of observed sets. The Northeast Distant (NED) fishing area was reopened to pelagic longline fishery effort during the thrid quarter of 2004 after being closed since June, 2001. Twenty sets were observed in this reopened area comprising approximately 21,000 hooks (Table 1).

There were 13 observed interactions with leatherback turtles and 8 interactions with loggerhead turtles during this quarter (Table 2). One marine turtle was recorded as released alive and uninjured while the remainder were released alive and injured (Appendix A). The majority of interactions with both species were observed in the MAB area (Table 2). The locations of observed sets and turtle interactions are shown in Figure 1.

There were a total of 5 marine mammal interactions observed including pilot whales and Risso's dolphins (Table 3). Two pilot whales and both Risso's dolphins were determined to be seriously injured based upon the description of interactions with the fishing gear by the observer and established serious injury criteria (see Garrison, 2003). One pilot whale was released uninjured. Interactions with marine mammals were observed only in the MAB region (Figure 3).

The quarterly and regional bycatch rates are summarized for turtles in Table 4 and for marine mammals in Table 5. These rates are compared with those from the same quarter/area for 2003 and the average from 1999-2003 in Tables 6-7. Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A.

For leatherback turtles, the catch rate observed in the Gulf of Mexico was significantly lower than that observed during previous years in quarter 4. However, the interaction rate observed in the mid-Atlantic bight was unusually high given very low interaction rates in this area in previous years (Table 6a). The relatively high catch rate for leatherbacks in the NEC area during this year is consistent with that observed in previous years (Table 6a). The catch rate observed in the NED area was higher than that in 2003, but lower than the average over the previous five years. However, it is difficult to directly compare these rates as the fishery in the NED during 2001-2003 consisted of only experimental sets (Table 6a).

For loggerhead turtles, the bycatch rates in the GOM and MAB were consistent with those observed in previous years (Table 6b). The high interaction rate observed in the SAB was unusual compared to previous years; however, the bycatch rate estimate for this year is highly uncertain due to small sample sizes. In both the NEC and NED, the absence of loggerhead catches during the fourth quarter of 2004 was unusual compared to previous years (Table 6b).

The bycatch rates for pilot whales and Risso's dolphin in the MAB are consistent with those observed in previous years (Table 7). The third and fourth quarters in the MAB are the periods with consistently high interaction rates with pilot whales (Garrison, 2003; Garrison and Richards, 2004).

In addition to reopening the NED area, the June 2004 Biological Opinion mandated the use of 16/0 or 18/0 circle hooks in the longline fishery. The observed distribution of hooks reflect this mandate as J-hooks were not observed in the fishery (Figure 3a). This is in sharp contrast to the first two quarters of 2004 when the fishery consisted predominantly of 7/0 and 9/0 J hooks (Garrison, 2004). While the majority of the observed fishery employed 16/0 circle hooks (figure 3a), the majority of turtles were observed captured on 18/0 circle hooks Figure 3b). Concerted efforts by fishermen to remove hooks and disentangle captured turtles are also mandated by the Biological Opinion. In 9 of 12 hooked leatherback turtles, the hook was successfully removed and no leatherbacks were released with entangling gear (Appendix A). In 5 of 8 captured loggerhead turtles the hook was successfully removed (Appendix A).

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have gone through an initial audit and review, they are subject to change upon further review after the end of the 2004 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch consistent with previous estimates (e.g., Garrison 2003). This approach assumes 1) that catch rates (animals per hook) are lognormally distributed and 2) that the number of hooks is an appropriate unit of effort. The first assumption has been evaluated for turtles; however, violations of this assumption may result in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. If this assumption is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there is potentially a bias in the estimate of bycatch rate and total bycatch.

The interaction between longline gear and marine turtles is a relatively rare event and is therefore inherently variable. Historically, there have been very large interannual fluctuations in bycatch rates and therefore estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may be simply stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

Angliss, R.P. and D.P. DeMaster. 1998. Differentiating serious and non-serious injury of marine mammals taken incidental to commercial fishing operations. NOAA Technical Memorandum NMFS-OPR-13: 48 p.

Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NOAA FISHERIES-SEFSC-515: 52 p.

Garrison, L.P. 2004. Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery During January – June, 2004. SEFSC Document #PRD-03/04-10: 19 p.

Garrison, L. P. and P. M. Richards. 2004. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2003. NOAA Technical Memorandum NMFS-SEFSC-527: 57 p.

Table 1. Number of sets and hooks (x1000) observed in the U.S. Atlantic Pelagic Longline Fishery between 1 October – 31 December, 2004 by fishing area.

Area	Sets	Hooks (x 1000)
CAR	0	0
FEC	6	1.52
GOM	70	50.30
MAB	35	32.34
NCA	0	0
NEC	3	3.72
NED	20	21.08
SAB	7	3.40
SAR	0	0
TUN	0	0
TUS	0	0
Total	**141**	**112.36**

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 October – 31 December, 2004 by fishing area. All turtles were recorded as being released alive. Areas with missing values indicate no observer coverage during this time period.

Area	Leatherback	Loggerhead
CAR	-	-
FEC	0	0
GOM	1	2
MAB	9	4
NCA	-	-
NEC	1	0
NED	2	0
SAB	0	2
SAR	-	-
TUN	-	-
TUS	-	-
Total	**13**	**8**

Table 3. Interactions with marine mammals observed during 1 October – 31 December 2004 in the U.S. Atlantic Pelagic Longline Fishery. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluated serious injury.

Species	Region	Quarter	# Released Un-injured	# Dead	# Serious Injury
Pilot Whale	MAB	4	1	0	2
Risso's Dolphin	MAB	4	0	0	2

Table 4. Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and during 1 October – 31 December, 2004 in the U.S. Atlantic Pelagic longline fishery. Missing values indicate areas with no observer coverage. CV indicates the coefficient of variation of the estimated rate. All turtles were recorded as released alive.

A. Leatherback Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	6	0	0.0000	-	-
GOM	70	1	0.0161	0.0003	1.00
MAB	35	7	0.2374	0.0075	0.36
NCA	0	-	-	-	-
NEC	3	1	0.3086	0.0953	1.00
NED	20	2	0.1139	0.0063	0.70
SAB	7	0	0.0000	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

B. Loggerhead Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	6	0	0.0000	-	-
GOM	70	1	0.0386	0.0015	1.00
MAB	35	4	0.1234	0.0039	0.51
NCA	0	-	-	-	-
NEC	3	0	0.0000	-	-
NED	20	0	0.0000	-	-
SAB	7	2	0.4006	0.0671	0.65
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

Table 5. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter during 1 July – 30 September, 2004 in the U.S. Atlantic Pelagic longline fishery. CV indicates the coefficient of variation of the estimated rate.

Species	Serious Injury ?	Area	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
Pilot Whale	Y	MAB	2	35	0.0739	0.0027	0.70
Pilot Whale	N	MAB	1	35	0.0408	0.0017	1.00
Risso's Dolphin	Y	MAB	2	35	0.0644	0.0022	0.72

Table 6. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 October – 31 December, 2004 and comparison to 2003 and the average rate from 1999-2003. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates.

A. Leatherback turtles

Area	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
CAR	-	-	-	-	-	-
FEC	0.0000	-	0	-	0.1452	0.0297 – 0.7097
GOM	0.0161	0.0033 – 0.0788	0.4833	0.3062 – 0.7628	0.1869	0.1245 – 0.2807
MAB	0.2374	0.1212 – 0.4648	0	-	0.0847	0.0421 – 0.1703
NCA	-	-	-	-	-	-
NEC	0.3086	0.0631 – 1.509	0.4007	0.2109 – 0.7615	0.3763	0.2005 – 0.7061
NED[1]	0.1139	0.0344 – 0.3775	0.0732	0.0367 – 0.1459	0.2508	0.2023 – 0.3111
SAB	0.0000	-	0	-	0.1799	0.0541 – 0.5992
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

B. Loggerhead Turtles

Area	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
CAR	-	-	-	-	0.2451	0.0501 – 1.198
FEC	0.0000	-	1.4029	0.5003 – 3.934	0.5532	0.2379 – 1.286
GOM	0.0386	0.0079 – 0.1887	0.0352	0.0106 – 0.1177	0.0238	0.0094 – 0.0599
MAB	0.1234	0.0495 – 0.3078	0	-	0.1527	0.0822 – 0.2837
NCA	-	-	-	-	-	-
NEC	0.0000	-	0.1579	0.0494 – 0.5046	0.1845	0.0853 – 0.3989
NED[1]	0.0000	-	0.3978	0.2153 – 0.7350	0.5305	0.4028 – 0.6989
SAB	0.4006	0.1299 – 1.2356	0	-	0.1793	0.0653 – 0.4924
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

[1] Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from "normal" fishery operations.

Table 7. Summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 July – 30 September, 2004 and comparison to rates from the previous year (2003) and the average of the previous five years (1999-2003). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Area	Species	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
FEC	Pilot Whale	0	-	0	-	0.1452	0.0297 – 0.7097
MAB	Common Dolphin	0	-	0.1253	0.0256 – 0.6126	0.0233	0.0047 – 0.1138
MAB	Pilot Whale	0.1147	0.0317 – 0.4154	0	-	0.1481	0.0607 – 0.3615
MAB	Risso's Dolphin	0.0644	0.0187 – 0.2215	0.1632	0.0606 – 0.4394	0.1151	0.0618 – 0.2139
NEC	Risso's Dolphin	0	-	0.3248	0.1509 – 0.6989	0.1342	0.0659 – 0.2727
NED[1]	Northern Bottlenose Whale	0	-	0	-	0.0024	0.0005 – 0.0115
NED[1]	Pilot Whale	0	-	0	-	0.0022	0.0004 – 0.0106
NED[1]	Risso's Dolphin	0	-	0.0069	0.0014 – 0.0336	0.0092	0.0032 – 0.0263
NED[1]	Striped Dolphin	0	-	0	-	0.0029	0.0006 – 0.0142
NED[1]	Unid. Mammal	0	-	0	-	0.0031	0.0006 – 0.0149

[1] Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from "normal" fishery operations.

Figure 1. Observed Pelagic Longline effort (light gray) and turtle (symbols) interactions during 1 October – 31 December, 2004. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

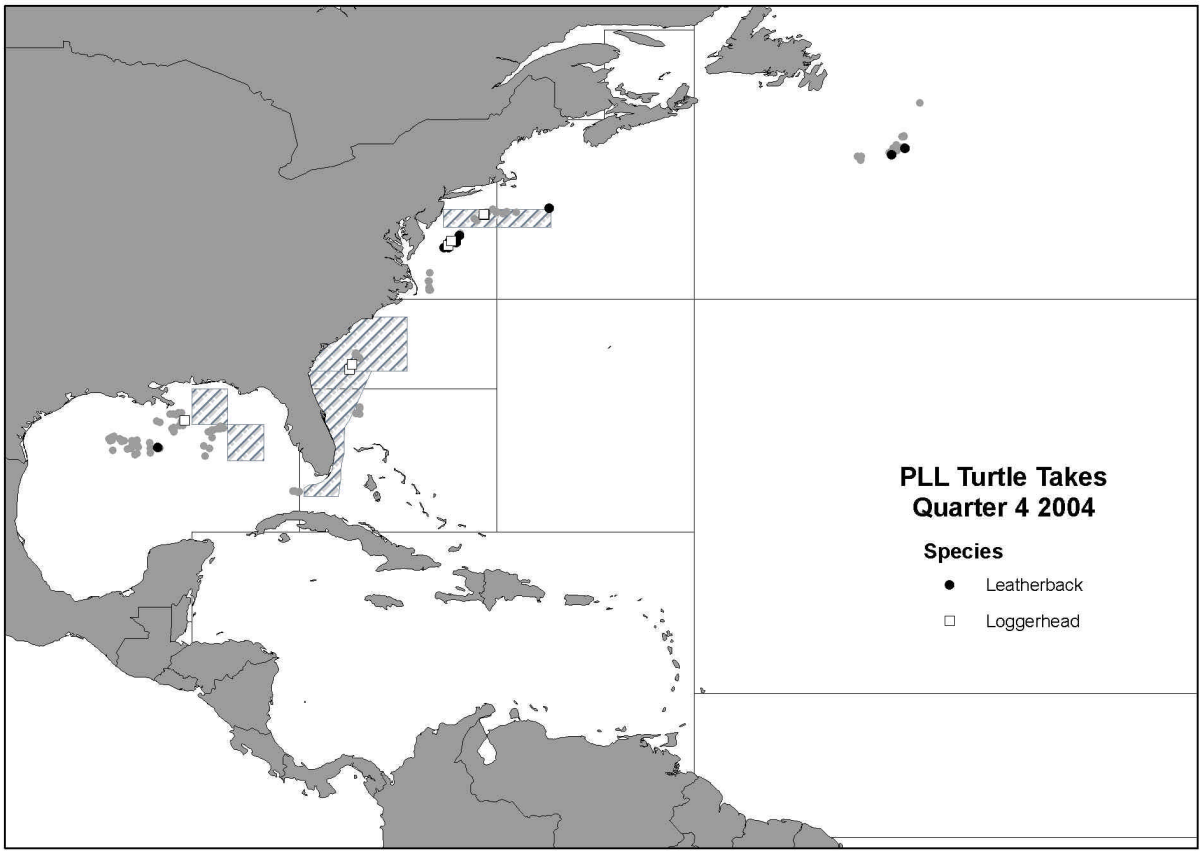


Figure 2. Observed Pelagic Longline effort and marine mammal interactions during 1 October – 31 December, 2004. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

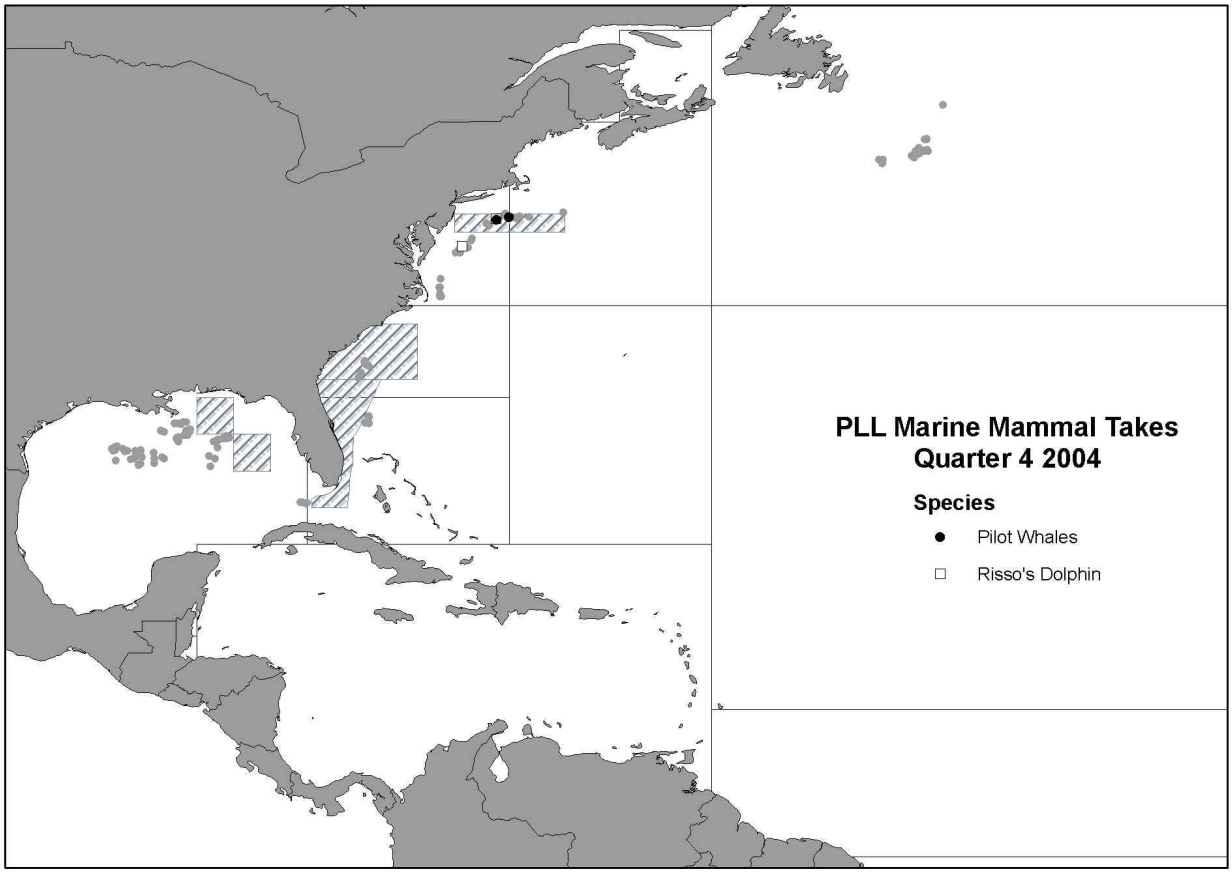
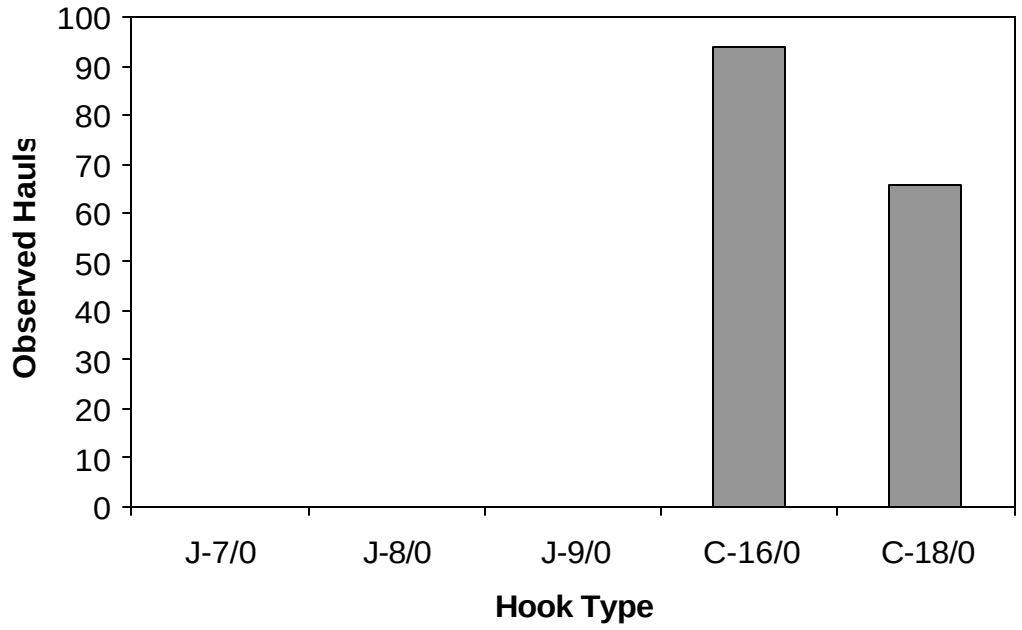


Figure 3. (A) Hook sizes and types observed in the pelagic longline fishery during quarter 4 of 2004 and (B) the number of turtles captured by hook type. In some cases, multiple hook types were reported in the same sets. Due to mandated gear changes, J hooks were not observed in the longline fishery during this quarter.

A.



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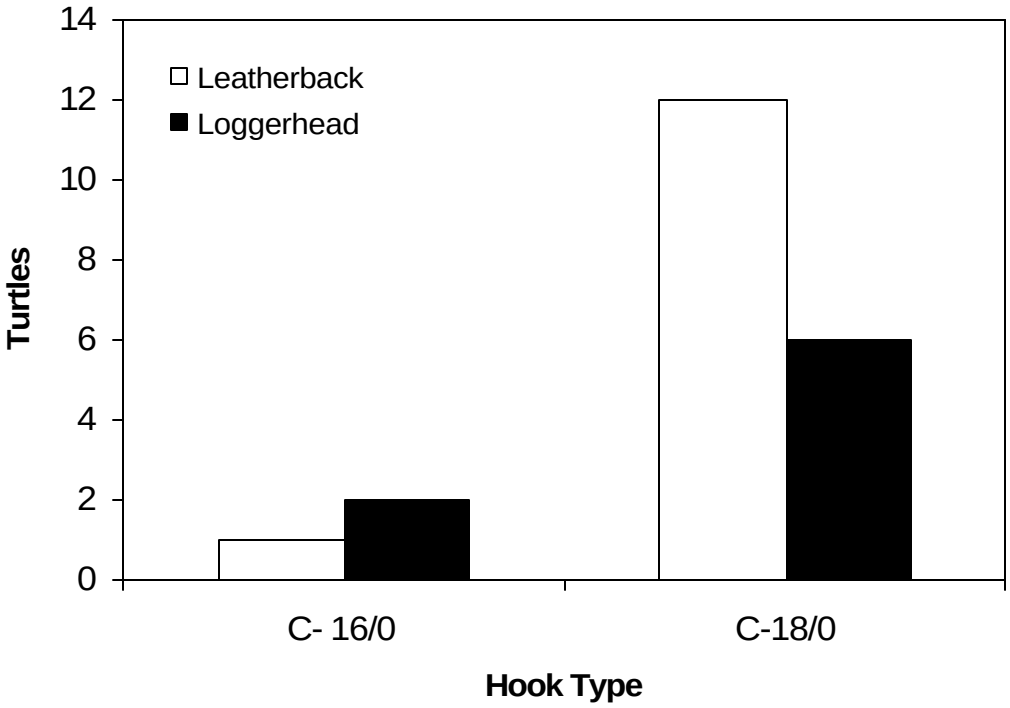

Appendix A: Injury details and hook type for turtles captured in the pelagic longline fishery for sets beginning during 1 October – 31 December, 2004. The hook type indicates the shape ("J" = j type, "C" = circle type) and size of hook that captured the turtle.

A. Leatherback Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	MAB	C-18/0	10	unk	196 or 360	Alive, injured	shoulder	na	na	yes	no	no	0.00	4.00		
2	MAB	C-18/0	10	unk	212 or 360	Alive, injured	armpit	na	na	yes	no	no	0.00	4.00		
3	NED	C-18/0	10	mackerel		Alive, injured	armpit	na	na	yes	no	no	0.00		152	
4	NED	C-18/0	10	unk		Alive, injured	front flipper/shoulder/armpit	na	na	no	no	no	0.00	5.00		
5	NEC	C-18/0	10	squid	251	Alive, injured	shoulder	na	na	yes	no	no	0.00	4.90		
6	MAB	C-18/0	10	squid	251	Alive, injured	shoulder	na	na	yes	no	no	0.00	4.60		
7	MAB	C-18/0	10	mackerel	382	Alive, injured	armpit	na	na	no	no	no	0.00	4.60		
8	MAB	C-18/0	10	mackerel		Alive, injured	carapace	na	na	no	no	no	0.00	4.60		
9	MAB	C-18/0	10	squid	251	Alive, uninjured	not hooked	na	na	na	yes	no	0.00	4.90		
10	MAB	C-18/0	10	squid	251	Alive, injured	front flipper	na	na	yes	no	no	0.00	5.20		

A. Leatherback Turtles (cont.)

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
11	MAB	C-18/0	10	squid	251	Alive, injured	armpit	na	na	yes	no	no	0.00	4.60		
12	MAB	C-18/0	10	squid	251	Alive, injured	front flipper	na	na	yes	yes	no	0.00	4.90		
13	GOM	C-16/0	0	squid	126	Alive, injured	armpit	na	na	yes	no	no	0.00	5.00		

B. Loggerhead Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	MAB	C-18/0	10	squid	270	Alive, injured	swallowed	na	partial hook	no	no	no	0.20		71.2	
2	MAB	C-18/0	10	unk	270 or 225	Alive, injured	front flipper	na	na	yes	yes	no	0.00		73.8	66.3
3	MAB	C-18/0	10	mackerel	382	Alive, injured	beak/mouth/tongue/glottis	lower other	na	yes	no	no	0.00		81.3	73.2
4	MAB	C-18/0	10	squid	251	Alive, injured	beak internal	lower other	na	yes	no	no	0.00		72.4	66.4
5	GOM	C-16/0	0	squid	158	Alive, injured	swallowed	na	not visible	no	no	no	5.00	2.20		
6	GOM	C-16/0	0	squid	158	Alive, injured	mouth	side other	na	no	no	no	1.00	1.80		

B. Loggerhead Turtles (cont.)

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
7	SAB	C-18/0	10	unk	372 or 168	Alive, injured	tongue	lower	visible to insertion pt	yes	no	no	0.00		81.7	73.8
8	SAB	C-18/0	10	unk	372 or 170	Alive, injured	mouth	other	na	yes	no	no	0.00		68.5	61